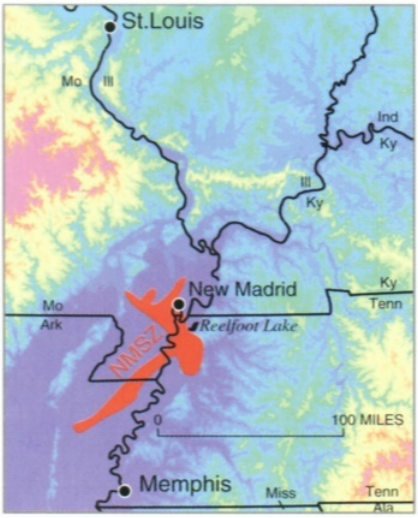
THE EARTHQUAKES THAT RESHAPED KENTUCKY

December 16, 1811
January 23, 1812
February 7, 1812

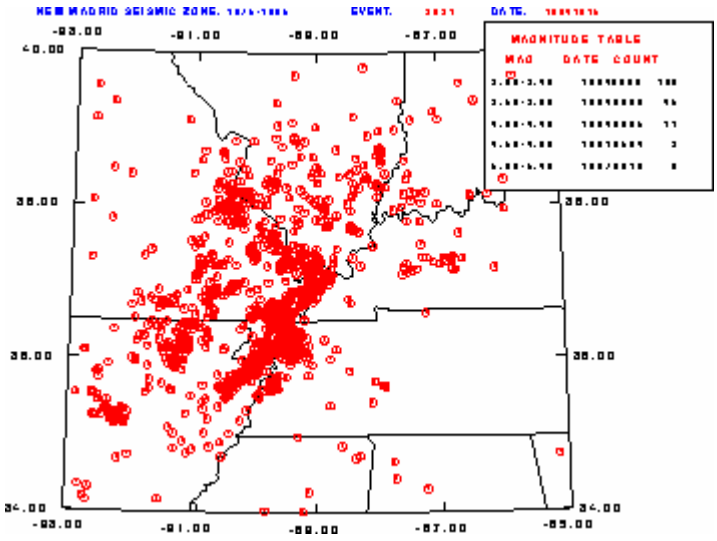
- The town of New Madrid, Missouri was completely destroyed.
- The ground rolled in visible waves.
- Vast areas of land sunk several feet, forming new lakes.
- Two six-foot waterfalls appeared in the river.
- The Reelfoot Scarp thrust upward several feet, making it look as if the great Mississippi had started flowing backwards.
- Riverbanks collapsed and huge landslides occurred.
- The ground liquefied, sending sand, mud, and coal shooting high into the air.
- Islands disappeared from the Mississippi River—including the island where the steamboat *New Orleans,* on her maiden voyage—was moored.
- Chimneys collapsed in St. Louis, Louisville, and Cincinnati.
- Ground shaking was felt as far away as Washington, DC and Boston, Massachusetts.

These accounts, all true, describe the great New Madrid Earthquakes of 1811-1812. They constitute the greatest sequence of earthquakes ever recorded in North America. Three of the New Madrid earthquakes are on the list of Top Five Largest Earthquakes in the Contiguous United States, and two are on the list of Top Ten Largest Earthquakes in U. S. History!

These earthquakes occurred in one of the most seismically active regions of the United States, called the **New Madrid Seismic Zone** after the destroyed town of New Madrid. The NMSZ extends northeast from Arkansas, through southeast Missouri, western Tennessee and Kentucky, then northward into southern Illinois.



The red area indicates the greatest area of earthquake concentration, historically, in the NMSZ.
Credit: USGS



This map identifies earthquakes from 1975-1995.

Read a few of the primary sources—the eyewitness accounts of the events:

16 December 1811
"There was a great shaking of the earth this morning. Tables and chairs turned over and knocked around - all of us knocked out of bed. The roar I thught would leave us deaf if we lived…You could not hold onto nothing neither man or woman was strong enough - the shaking would knock you lose like knocking hicror nuts out of a tree…we was all banged up and some of us knocked out for awile and blood was every where.

23 January 1812
…*We lost our Amandy Jane in this one - a log fell on her. We will bury her upon the hill under a clump of trees where Besys Ma and Pa is buried. A lot of people thinks that the devil has come here. Some thinks that this is the beginning of the world coming to a end.*
--George Heinrich Crist, Nelson County, Kentucky

…The earth seemed convulsed—the houses shook very much—chimnies falling in every direction. The loud, hoarse roaring which attended the earthquake, together with the cries, screams and yells of people, seems still ringing in my ears…
--Account of an unnamed resident published in the *Lexington Reporter*

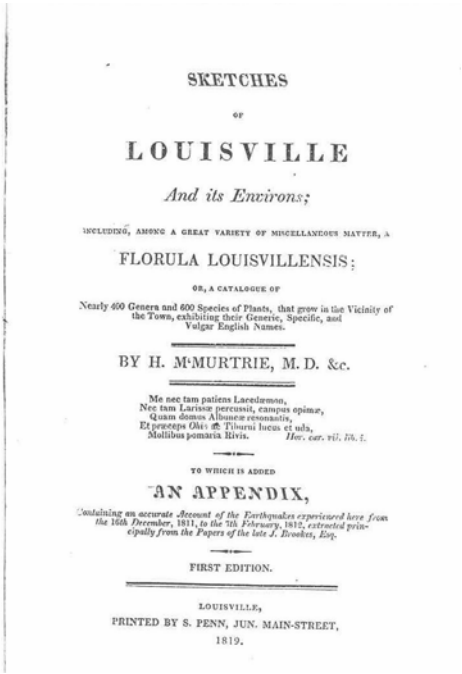
At 24 minutes past 2 o'clock A.M. mean time, the first shock occurred. The motion was a quick oscillation or rocking…Its continuance…was six or seven minutes…It was so violent as to agitate the loose furniture of our rooms; open partition doors that were fastened with falling latches, and throw off the tops of a few chimnies in the vicinity of town.
--Dr. Daniel Drake, Cincinnati

For more primary source documents related to the great quakes, visit:
The New Madrid Compendium, Center for Earthquake Research and Information (CERI), Memphis
http://www.ceri.memphis.edu/compendium/

The Virtual Times: The Great New Madrid Earthquakes
http://hsv.com/genlintr/newmadrd/

The Most Widely Felt Quakes in the History of North America!
The New Madrid 1811-1812 earthquakes were the most widely felt earthquakes in the history of North America. They were felt over an area of about *2 million square miles*! By contrast, the famous 1906 earthquake in San Francisco, California was felt over 60,000 square miles. Compare the areas of damage (striped) and shaking (shaded) on this map.
Credit: USGS

Why Were the New Madrid Quakes Felt So Far Away? Most earthquakes occur along the edges of plate boundaries, where the rocks are hot and broken up. The New Madrid quakes occurred in the middle of a plate, where rocks are cold, thick, and brittle. The older, solid rock carries the movement farther from the epicenter.



SKETCHES

OF

LOUISVILLE

And its Environs;

INCLUDING, AMONG A GREAT VARIETY OF MISCELLANEOUS MATTER, A

FLORULA LOUISVILLENSIS;

OR, A CATALOGUE OF

Nearly 400 Genera and 600 Species of Plants, that grow in the Vicinity of the Town, exhibiting their Generic, Specific, and Vulgar English Names.

BY H. M'MURTRIE, M. D. &c.

Me nec tam patiens Lacedæmon,
Nec tam Larissæ percussit, campus opimæ,
Quam domus Albuneæ resonantis,
Et præceps Anio, & Tiburni lucus et uda,
Mollibus pomaria Rivis. *Hor. car. vii. lib. i.*

TO WHICH IS ADDED

AN APPENDIX,

Containing an accurate Account of the Earthquakes experienced here from the 16th December, 1811, to the 7th February, 1812, extracted principally from the Papers of the late J. Brookes, Esq.

FIRST EDITION.

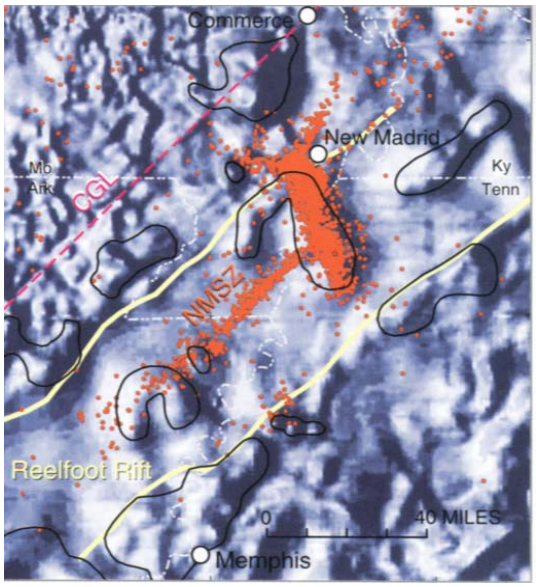
LOUISVILLE,
PRINTED BY S. PENN, JUN. MAIN-STREET,
1819.

1819 published account of the quakes

It is believed that as many as 3,600 earthquakes occurred during the three-month period from December 16, 1811 to February 7, 1812—an average of about 40 each day! Residents wondered if the ground would ever stop shaking. Louisville engineer Jared Brooks recorded 1,874 earthquakes using pendulums set up throughout his house. His observations, published by Henry McMurtrie in 1819, are one of the earliest chapters in the history of seismology.

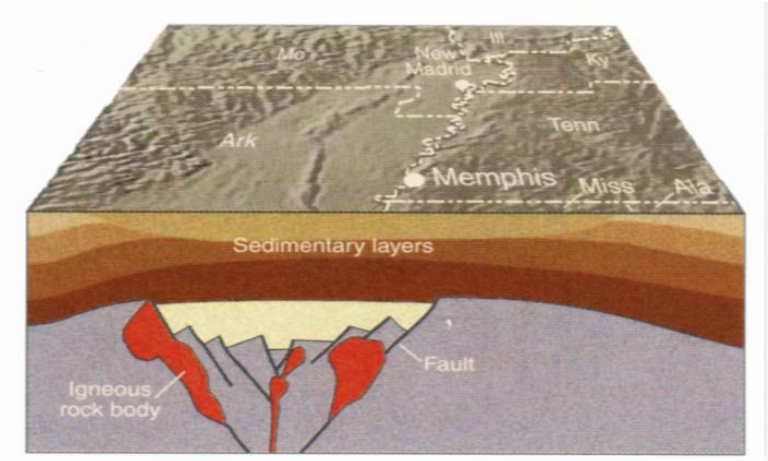
Why Is This Region So Seismically Active?

The **Reelfoot Rift** lies beneath the New Madrid Seismic Zone. Reelfoot Rift is a failed continental rift—a tear in the earth's crust that occurred when the North American Plate almost split apart 600 million years ago, then again 100-125 million years ago. Shown in a yellow outline here, the rift is 180 miles long and 50 miles wide.



Credit: USGS

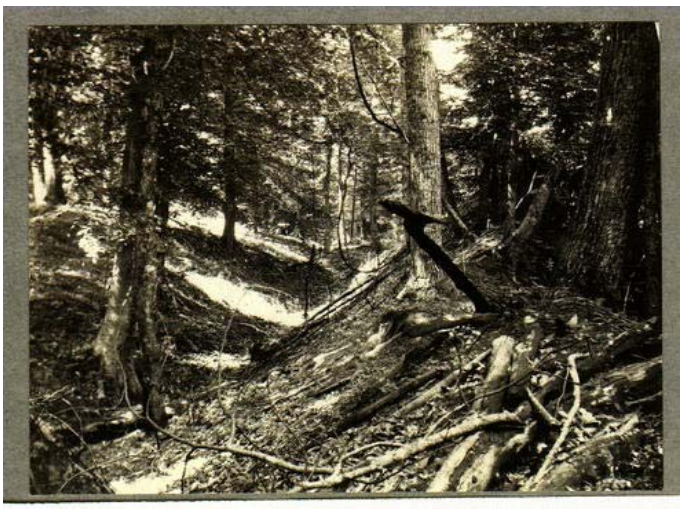
Reelfoot Rift is 25 miles beneath the surface. The New Madrid faults are like scar tissue left after this traumatic tectonic event.



Credit: USGS

Reelfoot Lake
The 1811-1812 earthquakes created Reelfoot Lake, located in Fulton County, Kentucky and Lake County, Tennessee. It is 14 miles long and 3-5 miles wide. Stumps of trees killed by the sudden submergence of the ground are still visible there.
Credit: Reelfoot Lake Watch Group

Scars left from the quakes
Nearly 100 years after the New Madrid earthquakes, geologist Myron Fuller recorded the evidence that still remained of land features altered by the events. His photos show landslide trenches and scarps, trees tilted by landslides and sand blows dotting the landscape. Some trees in the area had two sets of roots, after the trees were buried under five feet of sand and new roots sprouted from the trunk.

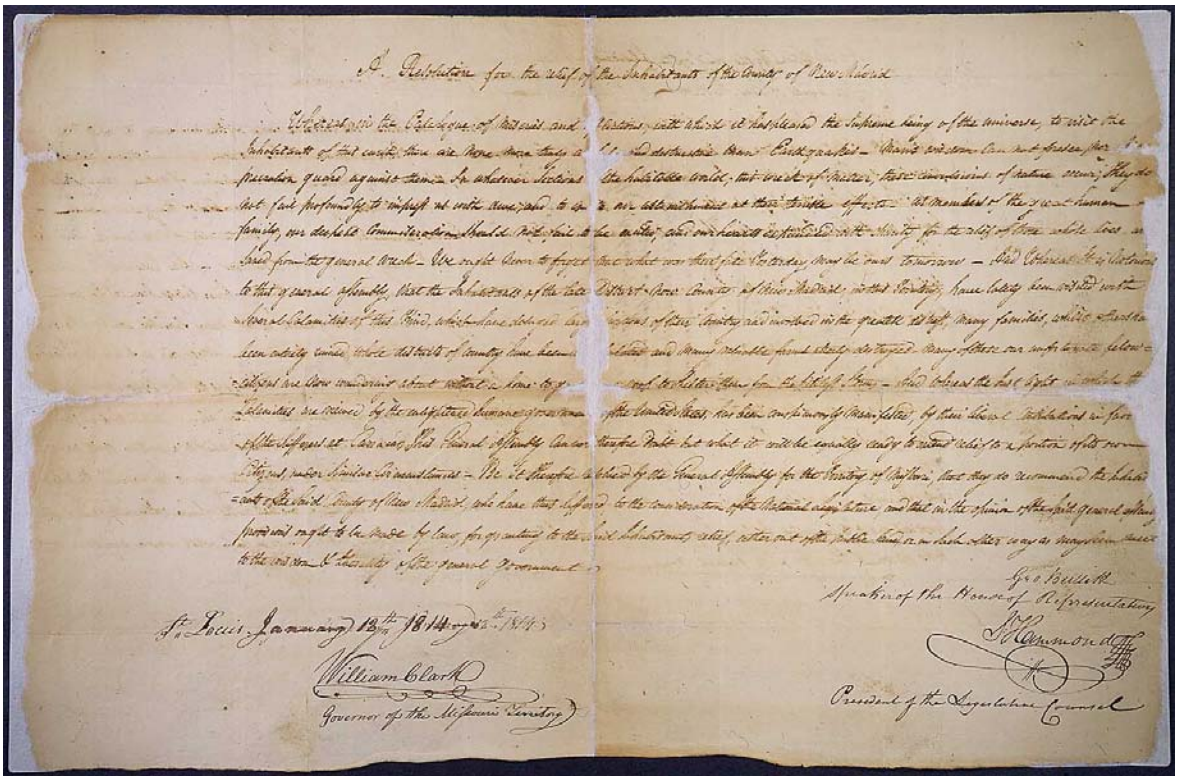


See more historic photos here:
USGS Earthquakes Hazards Program—Historic Photos from the 1811-1812 Earthquakes
http://neic.usgs.gov/neis/eq_depot/usa/1811-1812_pics.html

The Virtual Times: The Great New Madrid Earthquakes
http://hsv.com/genlintr/newmadrd/

The First Request for Disaster Relief in U.S. History

On January 13th, 1814, Missouri Territorial Governor, William Clark (yes, the William Clark from Kentucky who led the Lewis & Clark Expedition) wrote to ask for federal relief for the "inhabitants of New Madrid County". In response, Congress pledged $50,000 for recovery and passed the first **disaster relief** act in 1815. This is an image of his written request:



The Great Quakes Weren't the First Great Quakes

Paleoseismologists—scientists who study ancient earthquakes recorded in the geological record—have determined that the 1811-1812 quakes were not the first major ones to have occurred along the New Madrid Seismic Zone.

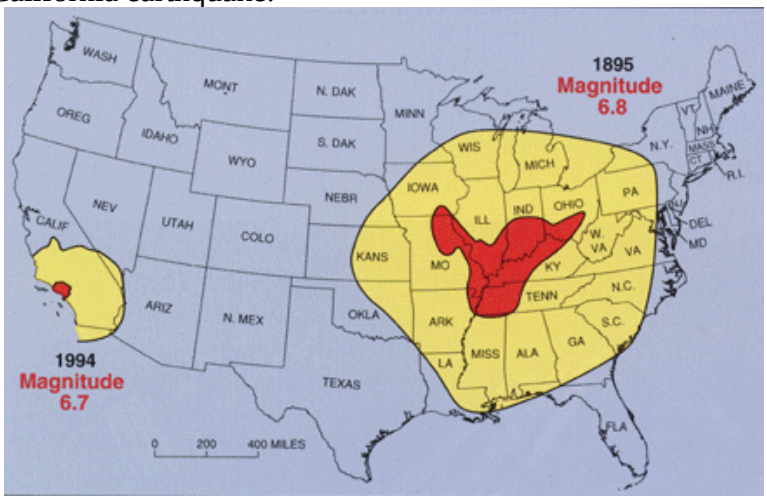
Trenches and core samples of soil and rock layers show evidence of sand blows, sand craters and dikes, landslides, and faulted layers of sediment and rock. Organic materials and even Indian artifacts in proximity to these features can be carbon-14-dated to determine when past earthquakes have occurred.

According to the evidence, big quakes occurred along the NMSZ in 500 AD, 900, and 1450—an average interval of 430 years.

Scientists dig trenches to study evidence of ancient earthquakes in rock and soil layers.

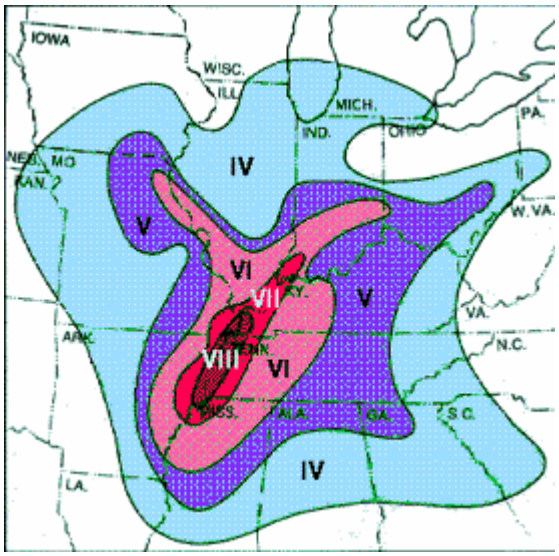
And They Won't Be the Last

Since 1812, the largest New Madrid earthquakes occurred on January 4, 1843 and October 31, 1895, with magnitude estimates of 6.3 and 6.8 respectively. As before, the area affected by the quakes was extensive. This image compares the 1895 quake in Charleston, Missouri with the 1994 Northridge, California earthquake.



Will they happen again? Scientists estimate that the probability of a magnitude 6 to 7 earthquake occurring in this seismic zone within the next 50 years is higher than 90%.

If the quakes equal the size of those in 1811-1812, scientists can anticipate the impact to the entire region.



This map shows the impact of a Magnitude 8.0 earthquake in the New Madrid Seismic Zone. The Roman numerals indicate intensities on the Modified Mercalli Scale. This is what they mean:

IV. During the day felt indoors by many, outdoors by few. At night some awakened. Dishes, windows, and doors disturbed; walls make creaking sound. Sensation like heavy truck striking building. Standing motorcars rock noticeably.
V. Felt by nearly everyone; many awakened. Some dishes, windows, etc., broken; a few instances of cracked plaster; unstable objects overturned. Disturbance of trees, poles, and other tall objects sometimes noticed. Pendulum clocks may stop.
VI. Felt by all; many frightened and run outdoors. Some heavy furniture moved; a few instances of fallen plaster or damaged chimneys. Damage slight.
VII. Everybody runs outdoors. Damage negligible in buildings of good design and construction slight to moderate in well built ordinary structures; considerable in poorly built or badly designed structures. Some chimneys broken. Noticed by persons driving motor cars.
VIII. Damage slight in specially designed structures; considerable in ordinary substantial buildings, with partial collapse; great in poorly built structures. Panel walls thrown out of frame structures. Fall of chimneys, factory stacks, columns, monuments, walls. Heavy furniture overturned. Sand and mud ejected in small amounts. Changes in well water. Persons driving motor cars disturbed.

Being Prepared

The American Red Cross and FEMA teach this safety procedure if you are indoors during an earthquake: DROP, COVER, AND HOLD ON!

DROP under a sturdy desk or table near an interior wall, away from windows and objects that could fall on you,
COVER your eyes by pressing your face against your arm,
and **HOLD ON!** to the table or desk, even if it starts to move.

For more information, see the Kentucky Earthquake Program Web site:
http://kyem.dma.ky.gov/earthquake/Earthquake%20Program%20Coordinator.htm

The Largest Earthquakes in United States History
Earthquakes in **bold** *directly impacted Kentucky.*

	Location	Date	Magnitude
1.	Prince William Sound, Alaska	March 28, 1964	9.2
2.	Rat Island, Alaska	February 4, 1965	8.7
3.	Andreanof Islands, Alaska	March 9, 1957	8.6
4.	East of Shumagin Islands, Alaska	November 10, 1938	8.2
5.	**New Madrid, Missouri**	**December 16, 1811**	**8.1**
6.	Yakutat Bay, Alaska	September 10, 1899	8.0
7.	Andreanof Islands, Alaska	May 7, 1986	8.0
8.	**New Madrid, Missouri**	**February 7, 1812**	**~8**
9.	Near Cape Yakataga, Alaska	September 4, 1899	7.9
10.	Fort Tejon, California	January 9, 1857	7.9
11.	Ka'u District, Island of Hawaii	April 3, 1868	7.9
12.	Gulf of Alaska	November 30, 1987	7.9
13.	Andreanof Islands, Alaska	June 10, 1996	7.9
14.	Denali Fault, Alaska	November 3, 2002	7.9
15.	**New Madrid, Missouri**	**January 23, 1812**	**7.8**

Note: Various magnitudes have been computed for some of these earthquakes. This data is based on the most current rankings by the U.S. Geological Survey.

The Largest Earthquakes in the History of the Contiguous United States
Earthquakes in **bold** *directly impacted Kentucky.*

	Location	Date	Magnitude
1.	**New Madrid, Missouri**	**December 16, 1811**	**8.1**
2.	**New Madrid, Missouri**	**February 7, 1812**	**~8**
3.	Fort Tejon, California	January 9, 1857	7.9
4.	**New Madrid, Missouri**	**January 23, 1812**	**7.8**
5.	Imperial Valley, California	February 24, 1892	7.8
6.	San Francisco, California	April 18, 1906	7.8
7.	Owens Valley, California	March 26, 1872	7.6
8.	N Cascades, Washington	December 15, 1872	7.3
9.	California/Oregon Coast	November 23, 1873	7.3
10.	Charleston, South Carolina	September 1, 1886	7.3

Note: Various magnitudes have been computed for some of these earthquakes. This data is based on the most current rankings by the U.S. Geological Survey.

